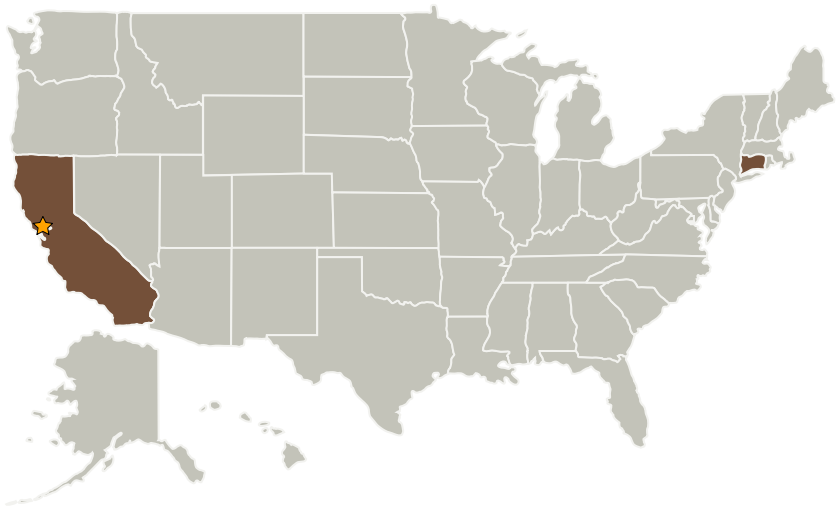
Elastomeric Dampers derived from First-Principles-Based Analytical Simulation, Phase II

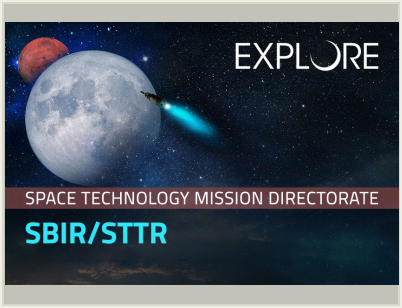
Completed Technology Project (2008 - 2011)

Project Introduction

Lead-lag motions of rotor blades in helicopters require damping to stabilize them. In practice, this has necessitated the use of external hydraulic dampers which suffer from high maintenance costs. High operational (lifecycle) cost has prompted rotorcraft industry to use elastomeric lead-lag dampers that result in "dry'' rotors. However, complex behavior of elastomers provides challenges for modeling such devices, as noted by rotorcraft airframers. Currently used analytical models oversimplify the complexity of operational environment and make radical assumptions about operating parameters that, at best, lead to excessively simplistic, and often unreal, device models. These first order linear device models require costly and time consuming experiments to construct them; moreover, they do not directly relate to either the material characteristics or the geometric configuration. In Phase-I SBIR, MTC team pursued a fundamentally radical approach wherein elastomeric dampers are derived from first-principle-based modeling rather than device model-based analyses. Our Phase-I program was tailored towards successfully demonstrating closed loop simulation, i.e. a finite element based modeling of elastomeric materials integrated into a multibody dynamics framework for rotorcraft analysis. During Phase-II, comprehensive and sophisticated material models will be implemented and streamlined into a single comprehensive analysis framework. These implementations will be fully validated against bench and flight test data of Bell M429 elastomeric dampers. These program objectives will be accomplished via collaborative tripartite partnership with Bell Helicopter and Georgia Tech.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Materials Technologies Corporation	Supporting Organization	Industry Minority-Owned Business, Small Disadvantaged Business (SDB)	Monroe, Connecticut

Primary U.S. Work Locations	
California	Connecticut

Project Transitions

December 2008: Project Start

August 2011: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.4 Vehicle Systems
    - TX09.4.5 Modeling and Simulation for EDL